ST3000 Wheel Drive Autopilot

Owner's Handbook

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Raymarine
ON BOARD

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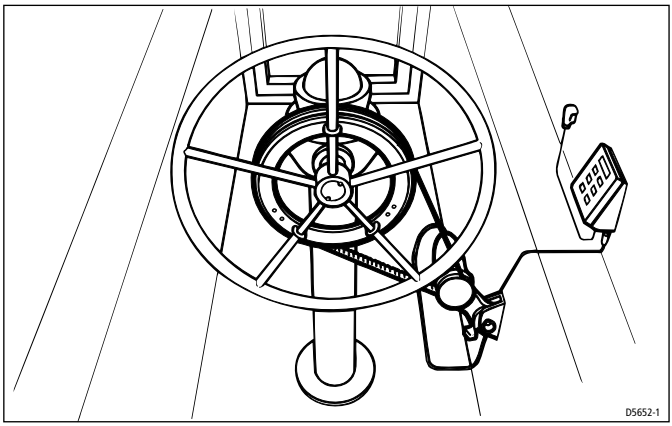
Chapter 1: Introduction

1.1 Overview



The ST3000 wheel pilot is a cockpit autopilot for wheel steered boats. It is designed for owner installation and consists of two main units:

- bracket mounted ST3000 control unit with built-in compass
- proven ST3000 wheel drive unit

ST3000 control unit

Operating modes

The wheel pilot has four basic operating modes:

- **Standby mode**: autopilot off
- **Auto mode**: autopilot engaged and locked onto a heading
- **Track mode**: autopilot on and maintaining a track between two waypoints created on a navigation system
- **Wind Vane mode**: autopilot on and maintaining a course relative to an apparent wind angle

SeaTalk and NMEA compatibility

The ST3000 control unit is SeaTalk compatible, so it can share data transmitted from other Raymarine SeaTalk instruments:

- wind information from a wind instrument can be used for wind vane steering without the need to install a separate vane

- track information, from a navigator, can provides waypoint control from the autopilot
- boat speed from a speed instrument can provide optimum track keeping performance
- SeaTalk compatibility also allows additional fixed and hand-held autopilot control units to be easily connected at secondary steering and control positions

With an optional SeaTalk/NMEA interface (part number: E85001) the wheel pilot can also be used with any navigator or position sensor transmitting NMEA 0183.

The ST3000 can be calibrated to suit each installation. This can provide optimum performance with many types of boat and steering systems.

ST3000 wheel drive unit

The wheel drive unit is attached by a single pin to a clevis permanently fixed to the cockpit structure. Drive is transmitted to the wheel by a tensioned toothed belt. A lever operated eccentric bush in the drive unit mounting arm enables belt tension to be released to facilitate manual override by allowing the belt to slip. The drive disengagement system is both effective and reliable.

CAUTION:

The ST3000 is recommended for wheel steered boats up to 7000 kg (15,000 lb) displacement. Above this limit and for heavy duty applications, such as single handed racing or long distance ocean sailing, we recommend one of the more powerful Raymarine autopilots (such as the ST5000+ system or Type 150/400 course computer).

1.2 Specifications

General specifications	
Power supply:	10 V to 15 V DC
Current consumption:	• Standby: 65 mA (120 mA with lighting) • Auto: between 0.7 A and 2.5 A depending on boat trim, helm load and sailing conditions
Operating temperature:	0°C to 70°C (32°F to 158°F)
Control unit	• 6 button digital keypad • Liquid Crystal Display (LCD) showing heading, locked course and navigational information • SeaTalk compatible • NMEA 0183 compatible via optional SeaTalk/NMEA interface
Drive unit:	• thrust torque: 70 Nm (52 lb.ft) • helm speed: 3 rpm • port or starboard mounting • 6 belt options • maximum displacement: 7,000 kg (15,000 lb)
Main features	• User calibration for optimum performance • 'WindTrim' control in Wind Vane mode • Automatic tack • Automatic compass deviation correction • Northerly/Southerly heading compensation • Automatic heading deadband • Built-in navigator interface • Track mode with waypoint advance feature

EMC conformance

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment. The design and manufacture of Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

1.3 About this handbook

Part 1: Using the Wheel Pilot

This part of the handbook explains how to use your wheel pilot:

2	**Chapter 2: Using the Wheel Pilot** How to use the wheel pilot.	page 9
3	**Chapter 3: Maintenance & Fault Finding** Provides maintenance and fault finding information.	page 29

Part 2: Installing the Wheel Pilot

This part of the handbook explains how to install your wheel pilot:

4	**Chapter 4: Installing the Wheel Pilot** How to install your wheel pilot and its components.	page 35
5	**Chapter 5: Commissioning the Wheel Pilot** How to check the wheel pilot and perform an initial sea trial.	page 53
6	**Chapter 6: Adjusting Wheel Pilot Settings** How to change the wheel pilot calibration settings.	page 61

Note: *This handbook contains important information about installing, using and maintaining your new Raymarine product. To get the best from the product, please read this handbook thoroughly.*

Important Information

Warranty

To register your new Raymarine product, please take a few minutes to fill out the warranty card. It is important that you complete the owner information and return the card to us to receive full warranty benefits.

Handbook information

To the best of our knowledge, the information in this handbook was correct when it went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and the handbook.

Safety notices

WARNING: Product installation

This equipment must be installed and operated in accordance with the instructions contained in this handbook. Failure to do so could result in poor product performance, personal injury and/or damage to your boat.

WARNING: Electrical safety

Make sure the power supply is switched off before you make any electrical connections.

WARNING: Navigation aid

Although we have designed this product to be accurate and reliable, many factors can affect its performance. As a result, it should only be used as an aid to navigation and should never replace common sense and navigational judgement. Always maintain a permanent watch so you can respond to situations as they develop.

Your Raymarine autopilot will add a new dimension to your boating enjoyment. However, it is the skipper's responsibility to ensure the safety of the boat at all times by following these basic rules:

- Ensure that someone is present at the helm AT ALL TIMES, to take manual control in an emergency.
- Make sure that all crew members know how to disengage the autopilot – **you cannot handsteer with the wheel pilot engaged**.
- Regularly check for other boats and any obstacles to navigation – no matter how clear the sea may appear, a dangerous situation can develop rapidly.
- Maintain an accurate record of the boat's position by using either a navigation aid or visual bearings.
- Maintain a continuous plot of your boat's position on a current chart. Ensure that the locked autopilot heading will steer the boat clear of all obstacles. Make proper allowance for tidal set – the autopilot cannot.
- Even when your autopilot is locked onto the desired track using a navigation aid, always maintain a log and make regular positional plots. Navigation signals can produce significant errors under some circumstances and the autopilot will not be able to detect these errors.

Part 1: Using the Wheel Pilot

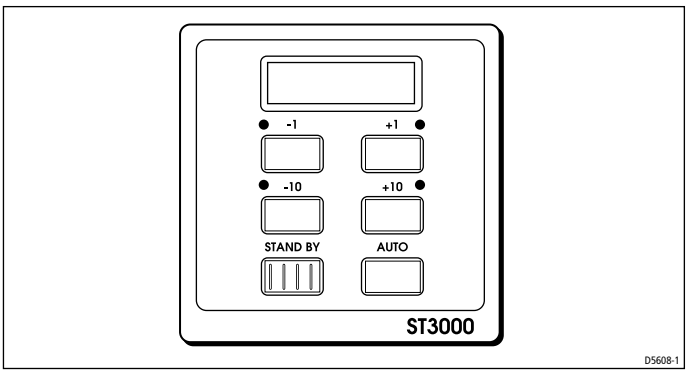
Chapter 2: Using the Wheel Pilot

2.1 Overview

WARNING:

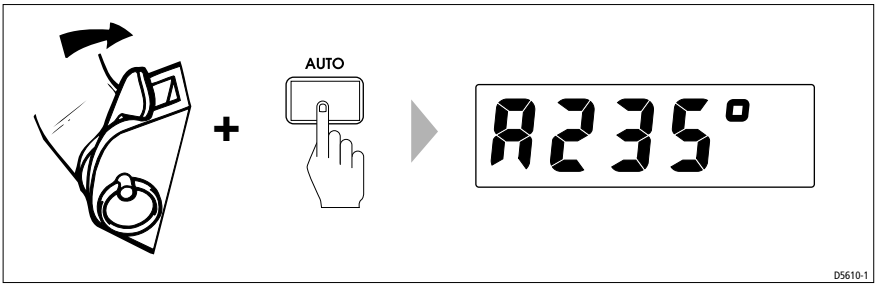
Passage making under autopilot control is an enjoyable experience that can, if you are not careful, lead to the relaxation of the permanent watch. Always maintain a permanent watch no matter how clear the sea may appear to be.

- The wheel pilot always powers up in Standby mode (indicated by a flashing 'C' alongside the boat's current compass heading).
- The wheel pilot is controlled using simple push-button operations. The control unit confirms all button presses with a short beep. In addition to the main single key functions, there are several dual key operations.
- To select automatic steering:
  - steady the boat on the required heading
  - engage the wheel drive clutch
  - press **AUTO**: the display will then show an '**A**' alongside the current heading
- To return to manual steering at any time:
  - press **STANDBY**
  - disengage the clutch lever
- You can use the **-1**, **+1**, **-10**, and **+10** keys to make course changes when the boat is under autopilot control.



2.2 Using Auto mode

Engaging the autopilot (Auto mode)

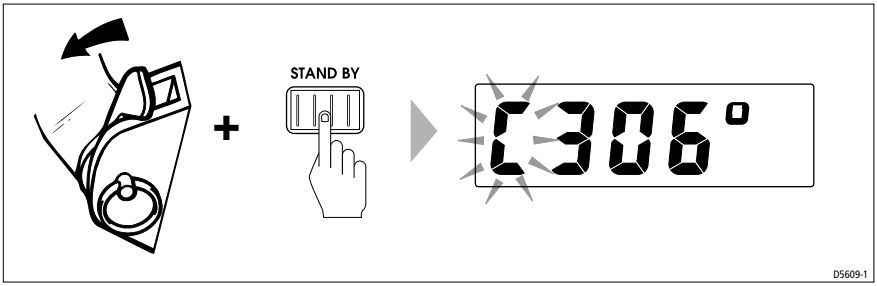


1. Steady the boat on the required heading.
2. Engage the wheel drive clutch by rotating the clutch lever clockwise.
3. Press **auto**: the wheel pilot will enter Auto mode and the display will show an 'A' (for auto) alongside the locked autopilot heading.

Disengaging the autopilot (Standby mode)

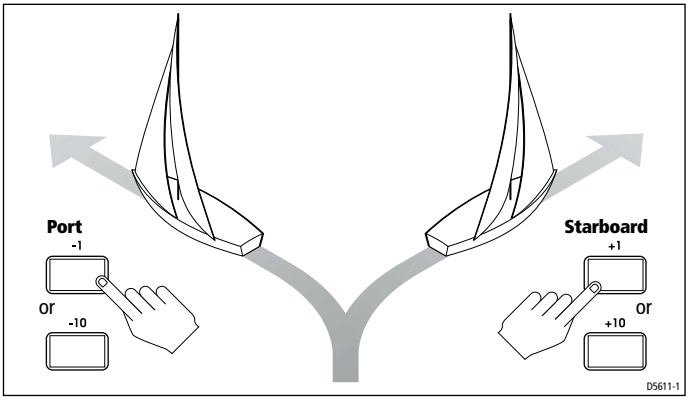
To return to hand steering:

1. Press **standby**: the wheel pilot will return to Standby mode. The display will show a flashing 'C' and the boat's current compass heading.
2. Disengage the wheel drive clutch by rotating the clutch lever anti-clockwise.
3. The last heading is memorized and can be recalled (see *page 13*).

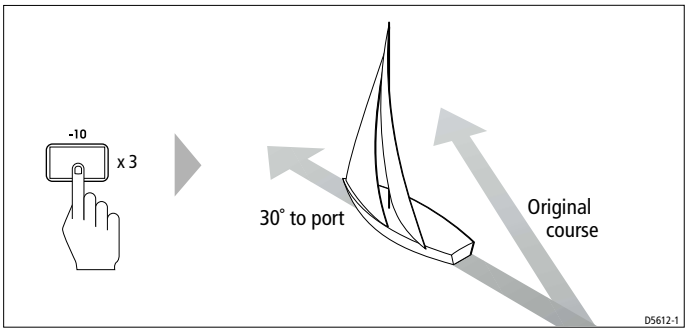


Changing course

In Auto mode, use the **-1** and **-10** (port) and **+1** and **+10** (starboard) keys to change course in steps of 1° and 10°.



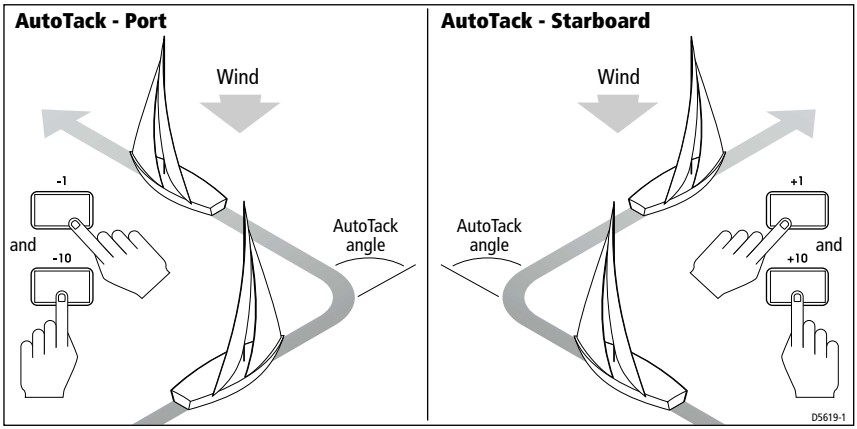
For example: press **-10** three times for a 30° course change to port:



Automatic tack feature (AutoTack)

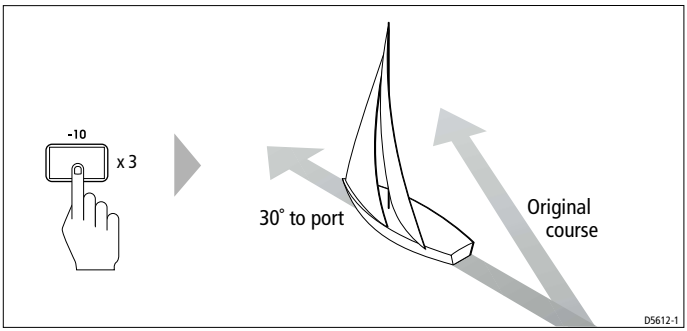
The autopilot has a built-in automatic tack facility (in Auto and Wind Vane modes) that turns the boat through 100°:

- to AutoTack 100° to port, press **-1** and **-10** together
- to AutoTack 100° to starboard, press **+1** and **+10** together



Dodging obstacles

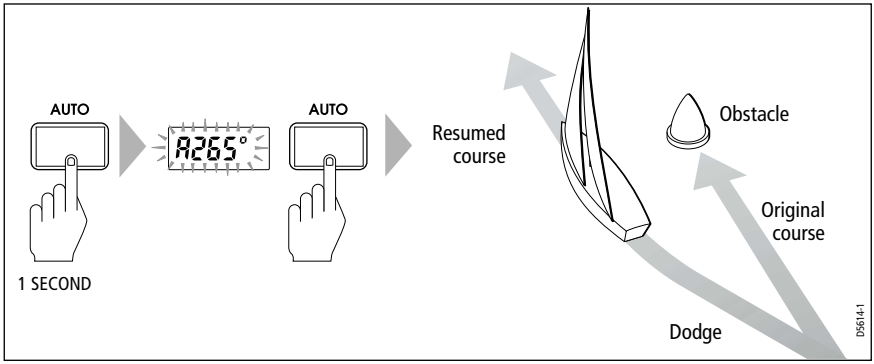
1. To avoid an obstacle when you boat is under autopilot control, select a course change in the appropriate direction. For example, press **-10** three times for a 30°dodge to port.



2. When safely clear of the obstacle, you can either:
   - reverse the previous course change (for example, by pressing **+10** three times), or
   - return to the previous heading (see below)

Returning to the previous heading

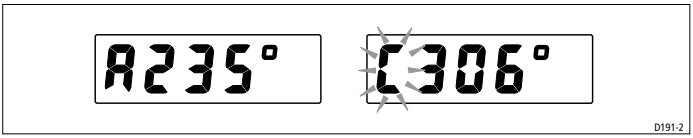
1. Press **AUTO** for 1 second: the previous heading will flash for 10 seconds.
2. To accept the previous heading, press **AUTO** again while the previous heading is flashing.



Note: *If you do not press* **AUTO** *while the display is flashing, the autopilot will maintain the current heading.*

Off course alarm

The off course alarm sounds if the locked autopilot heading and the boat's current heading differ by more than the value set in Calibration Level 6 (see *page 64*) for 20 seconds.



Cancelling the off course alarm

To cancel the off course alarm, press **STANDBY** to return to manual steering.

Note: *The off course alarm is usually an indication that the boat is carrying too much sail, or that the sails are badly balanced. In these conditions, you can usually significantly improve course keeping by improving the sail balance.*

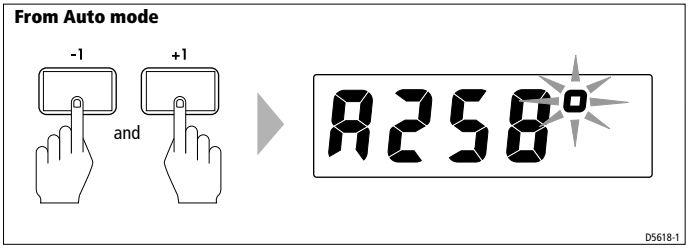
Automatic deadband control (Auto Seastate)

The wheel pilot is set to AutoSeastate (automatic deadband control) as a default. This causes the pilot to gradually ignore repetitive movements of the boat and respond only to true course variations.

By preventing unnecessary rudder movement, AutoSeastate provides the best compromise between power consumption and course keeping accuracy.

If you want to switch off the AutoSeastate feature:

1. With the pilot in Auto mode, press **-1** and **+1** together to switch from AutoSeastate to Fixed Minimum Deadband (1°).
2. The "°" sign flashes when Fixed Minimum Deadband is selected. Minimum deadband provides the tightest course keeping possible, at the expense of increased power consumption and drive unit activity.



To switch back to AutoSeastate, press **-1** and **+1** again.

Note: *The autopilot reverts to Automatic Deadband Control each time you select Standby mode.*

Operating hints – trim changes

CAUTION:

Only make major course changes when steering MANUALLY. This ensures that the boat will safely clear any obstructions or other boats, and you can take into account the changed wind and sea conditions on the new heading before engaging the autopilot.

Large course changes which change the apparent wind direction can produce large trim changes. When a sudden trim change occurs (for example due to weather helm or sail imbalance) there will be a delay of up to one minute before the automatic trim applies rudder to restore the locked heading.

In these situations, the autopilot will not immediately assume the new automatic heading, and will only settle onto course when the automatic trim has been fully established. To minimize this problem, use the following procedure to make major course changes:

1. Note the required new heading.
2. Press **STANDBY**, disengage the clutch, and steer manually.
3. Bring boat onto the new heading and engage the clutch.
4. Press **AUTO** and let the boat settle on course.
5. Bring your boat onto the final course in 1° steps using **-1** or **+1**.

Gusting conditions

In gusting conditions, the course may tend to wander slightly, particularly if the sails are badly balanced. By improving sail balance, you can improve course keeping.

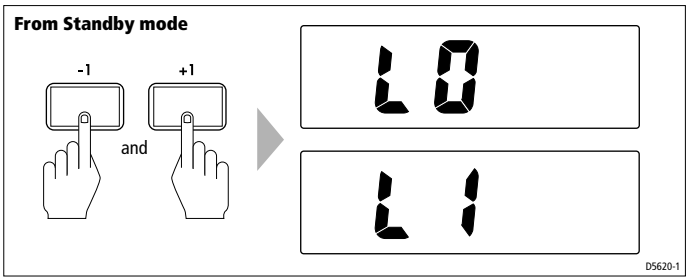
If you take the following precautions, the autopilot will be able to maintain competent control even in gale force conditions:

- Do not allow the boat to heel over excessively.
- Ease the mainsheet traveller to leeward to reduce heeling and weather helm.
- If necessary, reef the mainsail a little early.
- It is also advisable (whenever possible) to avoid sailing with the wind dead astern when there are very strong winds and large seas.
- Ideally, the wind should be at least 30° away from a dead run.
- In severe conditions, it may be advisable to remove the mainsail altogether and sail under headsail only.

2.3 Switching display illumination on and off

You can switch the display illumination on and off when the wheel pilot is in Standby mode:

- from Standby mode, press **-1** and **+1** together to switch the illumination between on (L1) and off (L0)
- to return to the previous mode either wait 10 seconds or press the appropriate mode key



Note: *The wheel pilot normally powers-up with the illumination switched on (*L1*).*

If other SeaTalk instruments or autopilot control units are connected via SeaTalk, you can also control the wheel pilot's illumination from these units.

2.4 Using Track mode

In Track mode, the wheel pilot maintains a track between waypoints created on a navigation system. The wheel pilot computes any course changes to keep your boat on track, automatically compensating for tidal streams and leeway. To operate in Track mode, the wheel pilot must receive cross track error information from either:

- a SeaTalk navigator, or
- a non-SeaTalk navigation system transmitting NMEA 0180 or 0183 data

Note: using NMEA 0180 navigators

NMEA 0180 equipment only transmits cross track error up to ±0.3 nm. This means that even if you are 5 nm to starboard of track, the transmitted data will still be 0.3 nm.

If you attempt to engage Track mode with the boat more than 0.3 nm from track, the boat will overshoot excessively and may even circle. For this reason, the Larger Cross Track Error alarm (see*page 24*) is displayed whenever cross track error is 0.3 nm or greater.

The requirement to remain within 0.3 nm of track also limits the maximum allowable angular error between the track course and the boat's heading. If the angular error is too great, the autopilot will be unable to cancel it within the 03 nm limit, leading to the problems outlined above.

NMEA 0183 transmit cross track error up to 99.99 nm and so enables Track mode to operate with larger cross track errors. However, the autopilot will still display the alarm if cross track error exceeds 0.3 nm in case there are any hazards close to the intended track.

Selecting Track mode

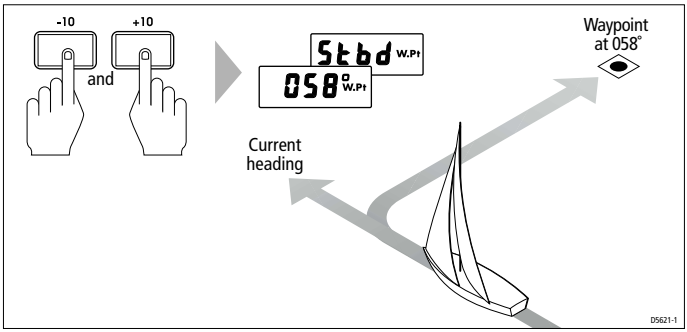
When you select Track mode, the wheel pilot can acquire the track in one of two ways:

- automatic acquisition – when both cross track error and bearing to waypoint data are available
- manual acquisition – when Cross Track Error is the only available information

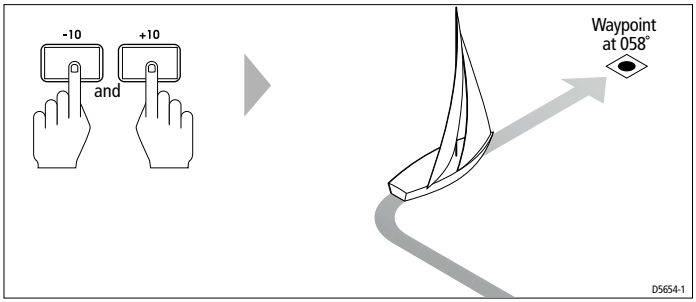
Automatic track acquisition

If cross track error and bearing to waypoint data are both available (via SeaTalk or NMEA), the pilot can acquire a track automatically:

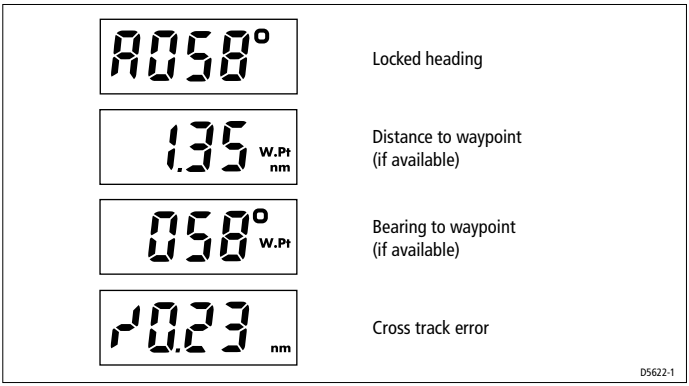
1. Bring the boat to within 0.1 nm of track.
2. Press **AUTO**.
3. Press **-10** and **+10** together to enter Track mode.
4. An alarm will sound and the display will alternate between:
   - the bearing to waypoint, and
   - the direction the boat will turn to take up the new track



5. Check that it is safe to turn the boat onto the new course.
6. Press **-10** and **+10** together:
   - the boat will now turn on to the new course
   - the alarm will cancel



7. The display will continuously cycle through the following navigation information pages:



Manual track acquisition

If your navigator only provides cross track error information, you must acquire the track manually:

1. Steer the boat to within 0.1 nm of track.
2. Bring the heading to within 5° of the bearing to the next waypoint.
3. Press **AUTO**.
4. Press **-10** and **+10** together to enter Track mode:
   - the autopilot will start tracking to the waypoint
   - the display will alternate between cross track error and the locked pilot heading

Manual track acquisition at low speeds

Using manual acquisition at low speeds requires additional care as tidal streams have a far more significant effect at lower speeds than at higher speeds.

In general terms, if the tidal flow is less than 35% of the boat's speed, you will not notice any difference in the wheel pilot's performance in Track mode. However, you should take extra care during manual acquisition, as follows:

- before you select Track mode, make sure that the boat is as close as possible to track, and that the direction made good over the ground is as close as possible to the direction of the next waypoint
- positive checks of the boat's position at regular intervals are vital, especially if you are close to potential navigational hazards

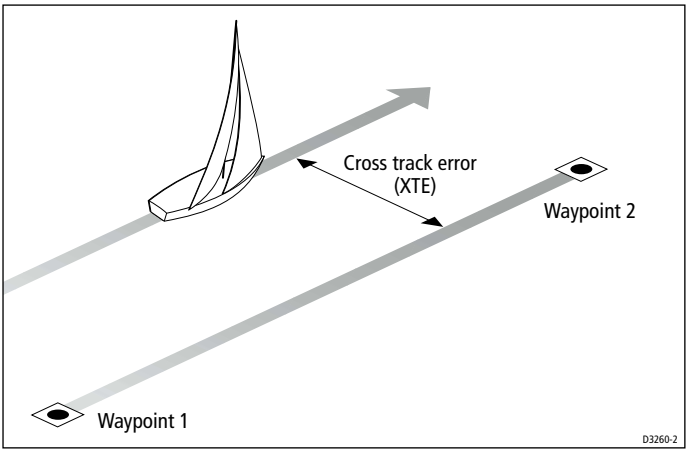
Returning to Auto from Track mode

To return to Auto mode from Track mode:

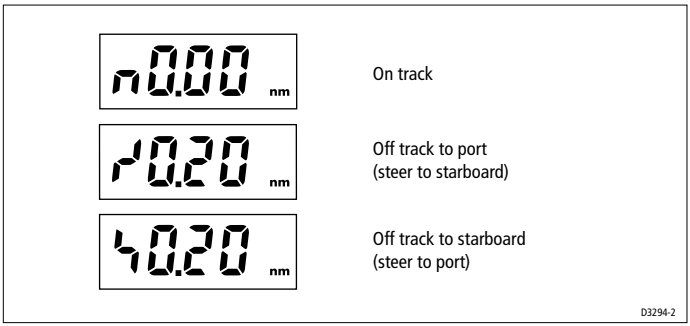
- press **AUTO**, or
- press **-10** and **+10** together.

Cross track error (XTE)

Cross track error (XTE) is the distance between your current position and the planned route. This is displayed in nautical miles (nm) and is taken directly from your navigator.



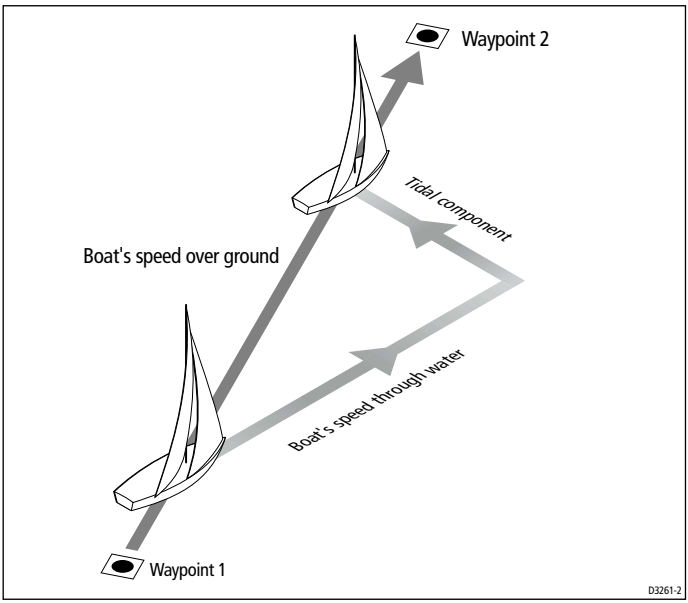
The wheel pilot displays the cross track error in the following ways:



Tidal stream compensation

Under most operating conditions, Track mode will hold the selected track to within ±0.05 nm (300 ft) or better.

The autopilot takes account of the boat's speed when computing course changes to ensure optimum performance over a wide range of boat speeds. If speed data is available, the autopilot will use the measured boat speed. Otherwise it will use the default cruise speed entered in Calibration Level 5 (see *page 64*).



Waypoint arrival and advance

IMPORTANT NOTE:

Waypoint advance will only operate if the wheel pilot receives valid waypoint name and bearing to waypoint information.

If your navigator transmits valid waypoint name and bearing to waypoint data, you can advance from one waypoint to the next by pressing **-10** and **+10** together.

Arrival

As the boat passes the target waypoint, the navigator manually or automatically selects the next target waypoint. The pilot will then:

- detect the new target waypoint name
- sound the waypoint advance alarm
- display the new bearing to waypoint and the direction the boat will turn to acquire it

Advance

When the waypoint advance alarm is sounding, the wheel pilot will suspend Track mode and maintain the current heading:

- check that it is safe to turn onto the new track
- press the **-10** and **+10** keys together: this will cancel the waypoint arrival alarm and turn the boat towards the next waypoint

Unless you accept the waypoint advance in this way, the alarm will continue to sound and the autopilot will maintain the current course.

Dodges in Track mode

In Track mode, you still have full control from the keypad:

- to make a dodge maneuver: use the **-1**, **+1**, **-10** or **+10** keys
- after you have avoided the hazard, reverse the course change selected for the dodge maneuver by selecting an equal course change in the opposite direction
- if the boat remains within 0.1 nm of track, there is no need to steer back towards the track

Safety in Track mode

WARNING:

Track mode provides accurate track keeping even in complex navigational situations. However, it is still the skipper's responsibility to ensure the safety of their boat at all times through careful navigation and frequent position checks.

Passage making in Track mode assists precise navigation and removes the tasks of compensating for wind and tidal drift. However, you MUST still maintain an accurate log with regular plots:

Confirming position at the start of a journey

- At the start of a journey you must always use an easily identifiable fixed object to confirm the fix given by the navigation system.
- Check for fixed positional errors and compensate for them.

Verifying computed positions

- Always verify the computed position with a dead reckoned position, calculated from the average course steered and the distance logged.

Plot frequency

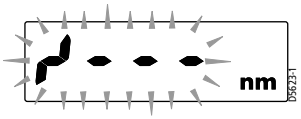
- In open water, you should make plots at least every hour.
- In confined waters or when near to potential hazards, you should make plots more frequently.

Setting waypoints

- Local variations in radio signal quality and changes in the tidal stream can produce deviations from the desired track. When setting waypoints, remember that deviations can occur.
- Thoroughly check along each track. Check up to 0.5 nm each side of the track to ensure that there are no hazards within this zone.
- For the waypoint advance function to work, the last four characters of adjacent waypoint names must be different.

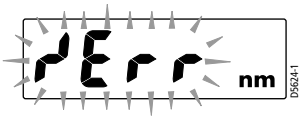
Warning messages in Track mode

Track data not received



The wheel pilot displays this message if you select Track mode when the autopilot is not receiving SeaTalk navigation data.

Track data error

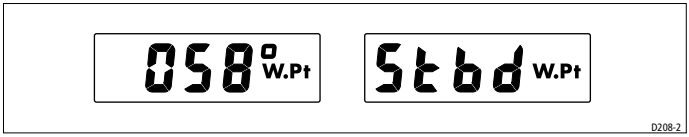


The wheel pilot displays this message if you select Track mode when the navigator has lost its fix.This display will clear as soon as the navigator regains its fix.

Large cross track error

This alarm sounds if cross track error exceeds 0.3 nm.

Waypoint advance



The waypoint advance alarm sounds whenever the target waypoint number changes:

- the pilot continues on its current heading, and the display alternates between the bearing to the next waypoint and the direction the boat will turn to take up that bearing
- make sure that the turn will be safe and, when you are ready to make the turn, momentarily press **-10** and **+10** together.
- the pilot will turn onto the new bearing and track towards the next waypoint

Note: *Waypoint advance will only operate if your pilot receives valid bearing to waypoint and waypoint number information.*

2.5 Using Wind Vane mode

Note: *You can only use Wind Vane mode if the wheel pilot is connected to a suitable wind sensor/instrument providing wind direction data.*

To use Wind Vane mode, the wheel pilot must receive wind information from one of the following sources:

- SeaTalk wind instrument
- NMEA wind instrument
- Raymarine pushpit wind vane (part number: Z159) connected via the supplied SeaTalk interface

In Wind Vane mode the wheel pilot maintains a course relative to an apparent wind angle. The pilot uses WindTrim to eliminate the effects of turbulence and short term wind variations. This provides smooth precise performance with minimum power consumption.

Wind Vane mode uses the fluxgate compass as the primary heading reference. When changes in the apparent wind angle occur, the wheel pilot adjusts the locked compass heading to maintain the original apparent wind angle.

In Wind Vane mode, the wheel pilot ignores short-term changes in wind direction, yet still tracks real wind shifts as subtle as 1°.

Selecting Wind Vane mode

From Standby mode or Auto mode, press **STANDBY** and **AUTO** together to select Wind Vane mode. The wheel pilot will then maintain the current apparent wind angle.

Note: *The autopilot beeps once every 30 seconds in Wind Vane mode.*

Exiting Wind Vane mode

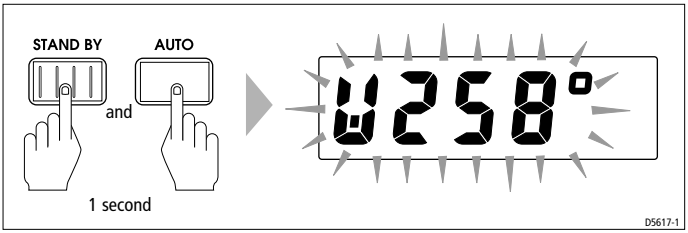
To exit Wind Vane mode:

- press **STANDBY** to return to Standby mode
- press **AUTO** to return to Auto mode

Returning to the previous apparent wind angle

If you have steered the boat away from the selected apparent wind angle (for example, performing a dodge maneuver or selecting Standby) you can return to the previous apparent wind angle:

1. Press and hold **STANDBY** and **AUTO** together for 1 second.
2. The display flashes the previous locked heading for 10 seconds.

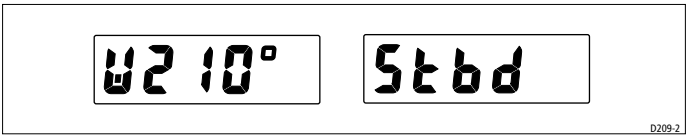


3. While the display is flashing, press **STANDBY** and **AUTO** together to select the previous heading:
   - when you select the previous heading, the 'W' flashes for 10 seconds to confirm the selection

Wind shift alarm

If changes in apparent wind angle alter the original locked compass heading by more than 15°, the wind shift alarm will sound.

The display alternates between the current Wind Vane heading and the direction of wind shift.



To cancel the wind shift alarm:

- check that the new course does not take the boat into danger
- press **STANDBY** and **AUTO** together momentarily to accept the alarm and reset the wind shift alarm value to the current compass heading

Operating hints for Wind Vane mode

- WindTrim filters the wind vane output. This provides optimum response for offshore conditions where genuine shifts in wind direction occur gradually.
- In gusting and unsteady inshore conditions, it is best to sail a few degrees further off the wind so that changes in apparent wind direction can be tolerated.
- It is important to minimize the amount of standing helm through careful sail trimming and positioning of the mainsheet traveller.
- It is recommended that the headsail and mainsail are reefed a little early rather than too late.

Chapter 3: Maintenance & Fault Finding

This chapter provides information about maintaining your wheel pilot system, obtaining product support and solving common problems.

3.1 General maintenance

CAUTION:

The control unit does not contain any user serviceable parts. It should be repaired only by authorized Raymarine service representatives.

Display condensation

- In certain conditions, condensation may appear on the LCD window. This will not harm the unit, and can be cleared by switching on the illumination for a while.

Routine cabling checks

- Make sure all connections are firmly attached.
- Examine the cable for signs of wear or damage – replace any damaged cables.

Cleaning the wheel pilot

- If the wheel drive or control unit are dirty, wipe them with a clean, damp cloth.
- **Never** use chemical or abrasive materials.

EMC advice

- When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, with a consequent adverse effect on operation.
- To minimize these effects and enable you to get the best possible performance from your Raymarine equipment, guidelines are given in the installation instructions, to enable you to ensure minimum interaction between different items of equipment, i.e. ensure optimum Electromagnetic Compatibility (EMC).

- Always report any EMC-related problems to your nearest Raymarine dealer. We use such information to improve our quality standards.
- In some installations, it may not be possible to prevent the equipment from being affected by external influences. In general this will not damage the equipment but it can lead to spurious resetting action, or momentarily may result in faulty operation.

3.2 Product support

Raymarine products are supported by a worldwide network of distributors and Authorized Service Representatives.

Before you consider returning the autopilot, make sure that the power supply cable is sound and that all connections are tight and free from corrosion. If the connections are secure, refer to the following Fault Finding section.

If you cannot trace or rectify the fault, contact either your national distributor, service representative, or the **Raymarine Technical Services Call Center**. Refer to the back cover or the Worldwide Distributor List for contact details.

Always quote the product serial number, which is printed on the back of the control unit.

3.3 Fault finding

All Raymarine products are designed to provide many years of trouble-free operation. We also put them through comprehensive testing and quality assurance procedures before shipping.

In the unlikely event that a fault does occur with your autopilot, use the following table to help identify the problem and provide a solution. If you cannot resolve the problem yourself, contact either your national distributor, service representative, or the **Raymarine Technical Services Call Center**.

SYMPTOM	SOLUTION
The autopilot display is blank.	No power – check the fuse/circuit breaker.
The displayed compass heading does not agree with the boat's compass.	The compass has not been corrected for deviation – carry out the deviation and alignment procedures (see page 56).
Drive unit steers hard over as soon as Auto is engaged	Drive operating sense set incorrectly. Refer to page 53.
Boat turns slowly and takes a long time to come on to course.	Rudder gain too low (see page 59).
Boat overshoots when turning on to a new course.	Rudder gain too high (see page 59).
The autopilot appears to be unstable on Northerly headings in Northern hemisphere (or Southerly headings in Southern hemisphere).	Northerly/Southerly heading correction not set up (see page 65).
Display shows 'CAL OFF' when entering calibration.	Calibration access has been prevented (see page 66).
The autopilot will not 'talk' to other SeaTalk instruments.	Cabling problem – make sure all the cables are connected properly.
Position information not received.	Navigator not transmitting the correct position data.
The autopilot will not auto advance to the next waypoint.	No bearing to waypoint information received from the navigator.
The autopilot will not display Distance to Waypoint, Bearing to Waypoint or Waypoint Number.	Incorrect NMEA sentences transmitted from position sensor. Refer to product handbook for information about information transmitted.
Drive slips under normal operating conditions.	Return the drive to your nearest service representative.

Part 2: Installing the Wheel Pilot

Part 2: Installing the Wheel Pilot

Chapter 4: Installing the Wheel Pilot

4.1 Planning the installation

Before you start installing your wheel pilot system, read through the following information and the relevant installation sections in this chapter.

Cabling guidelines

- consider how you will run cables to and from each component
- avoid running cables through bilges where possible
- avoid running cables close to fluorescent lights, engines, radio transmitting equipment etc.

EMC installation guidelines

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment.

Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

Although every effort has been taken to ensure that they will perform under all conditions, it is important to understand what factors could affect the operation of the product.

The guidelines given here describe the conditions for optimum EMC performance, but it is recognized that it may not be possible to meet all of these conditions in all situations.

To ensure the best possible conditions for EMC performance within the constraints imposed by any location, always ensure the maximum separation possible between different items of electrical equipment.

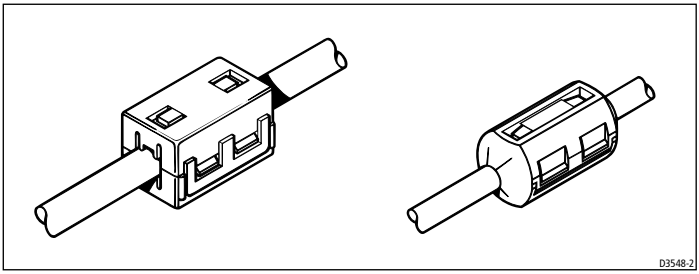
For **optimum** EMC performance, we recommend that:

- Raymarine equipment and cables connected to it are:
  - At least 3 ft (1 m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, increase the distance to 7 ft (2 m).
  - More than 7 ft (2 m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.

- The equipment is supplied from a separate battery from that used for engine start. Voltage drops below 10 V, and starter motor transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.
- Raymarine specified cables are used. Cutting and rejoining these cables can compromise EMC performance and must be avoided unless doing so is detailed in the installation manual.
- If a suppression ferrite is attached to a cable, this ferrite should not be removed. If the ferrite needs to be removed during installation it must be reassembled in the same position.

EMC suppression ferrites

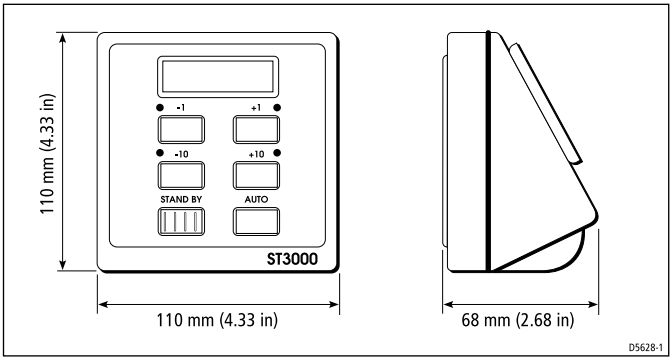
We supply the fluxgate compass and power cables with suppression ferrites fitted. Always use these ferrites supplied by Raymarine.



Connections to other equipment

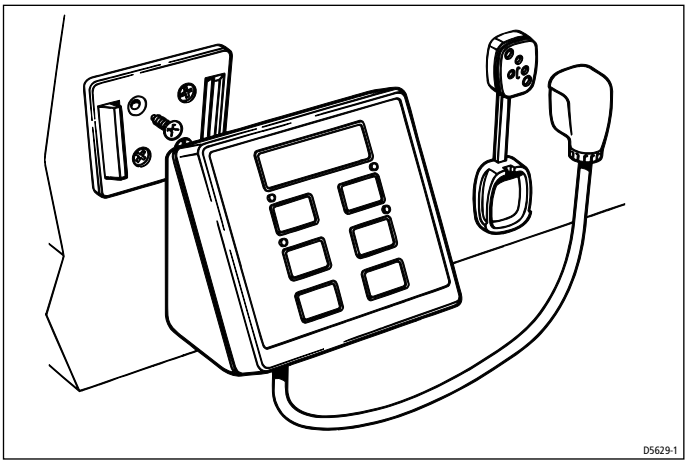
If your Raymarine equipment is to be connected to other equipment using a cable not supplied by Raymarine, a suppression ferrite MUST always be attached to the cable near to the Raymarine unit.

4.2 Control head installation



Mounting procedure

The control unit slots into a permanently mounted socket sited in the cockpit. It contains a gimballed fluxgate compass and therefore has some restrictions on mounting position.

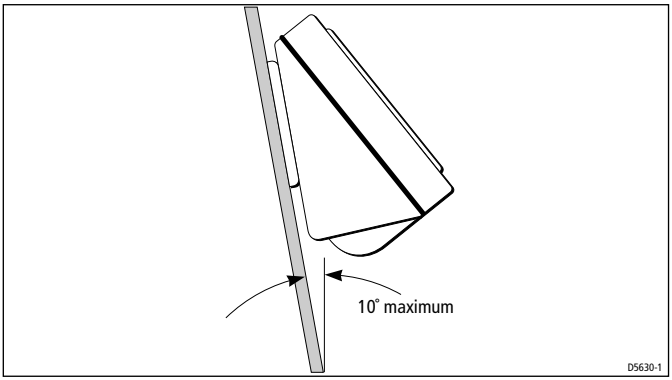


The control unit should be sited

- where it can be operated easily from the steering position.
- at least 80 cm (2.5 ft) away from the main steering compass to avoid deviation of both compasses
- as far away from other magnetic or iron devices as practical (to avoid compass deviation)

Having selected the best mounting site, secure the mounting socket to a convenient wooden or glass fibre surface using the self tapping screws provided.

The mounting surface should not be more than 10° from vertical. This will allow correct compass operation with the boat heeled at an angle of up to 40°.



Cabling and socket installation

Both power and SeaTalk data are supplied to the control unit via a custom waterproof plug and socket. The plug comes ready assembled and the socket can be mounted in the cockpit area adjacent to the autopilot. The control unit supplies power to the wheel drive unit via a cable plugged into the underside of the control unit.

Power supply

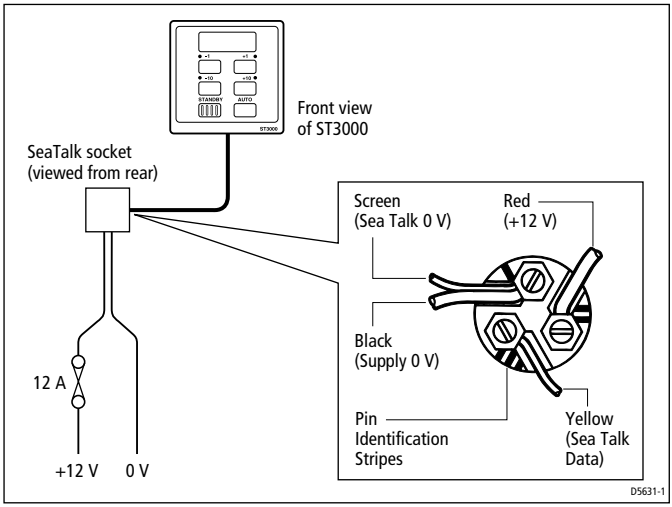
- The wheel pilot requires its own dedicated power supply – it cannot source its power from SeaTalk.
- The power supply should be taken directly from the boat's central distribution panel and protected with a **12 A fuse** or equivalent circuit breaker.

The following table shows the minimum cable size acceptable for the power supply:

Cable length	Copper area	AWG
Up to 2.5 m (8 ft)	1.5 mm^2	16
Up to 4 m (13 ft)	2.5 mm^2	14

IMPORTANT:

Correct power cable size is critical for correct autopilot operation. If in doubt, use a heavier gauge cable than specified. A lighter gauge cable may cause a voltage drop between the supply and the autopilot. This will reduce the power at the wheel.



SeaTalk cabling

The ST3000 control unit is SeaTalk compatible. It can receive and transmit information to other instruments and autopilot control units via the SeaTalk bus.

To connect the ST3000 control unit to the SeaTalk bus you will need a suitable SeaTalk interface cable (part numbers: D229 flat moulded plug, D179 male round plug, D181 female round plug) or a plugged SeaTalk cable with one end cut off:

- plug one end of the cable to the last instrument or control unit
- connect the cores at the other end to the SeaTalk socket as shown

CAUTION:

The fuse on the control unit power supply is too large to offer safe protection to the SeaTalk bus. You MUST protect the power supply for the SeaTalk 12 V (red) line with a 5 A fuse (or equivalent circuit breaker).

Raymarine produce a range of SeaTalk accessory cables you can use to connect the wheel pilot to SeaTalk instruments and control units:

- flat plugs for recent SeaTalk equipment (e.g. ST30, ST40, ST60)
- round plugs for older SeaTalk equipment (e.g. ST50)

Extension cables - flat moulded plugs at each end

Part no.	Type	Length
D284	Flat moulded plugs at each end	1 m (3 ft 3 in)
D285	Flat moulded plugs at each end	3 m (9 ft 10 in)
D286	Flat moulded plugs at each end	5 m (16 ft 5 in)
D287	Flat moulded plugs at each end	9 m (29 ft 6 in)
D288	Flat moulded plugs at each end	20 m (65 ft 6 in)

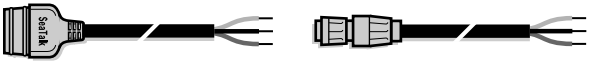
Conversion cables - flat moulded plug to round plug

Part no.	Type	Length
D187	Flat moulded plug to male round plug	0.15 m (6 in)
D188	Flat moulded plug to female round plug	0.3 m (12 in)

Extension cables - round plugs at each end

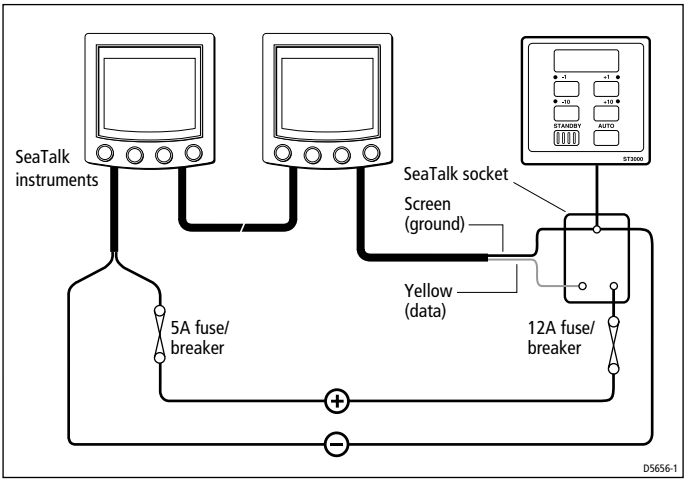
Part no.	Type	Length
D124	Male round plug to female round plug	1 m (3 ft 3 in)
D125	Male round plug to female round plug	3 m (9 ft 10 in)
D126	Male round plug to female round plug	6 m (19 ft 8 in)
D154	Male round plug to female round plug	9 m (29 ft 6 in)

Interface cables - flat moulded/round plug to bare ends

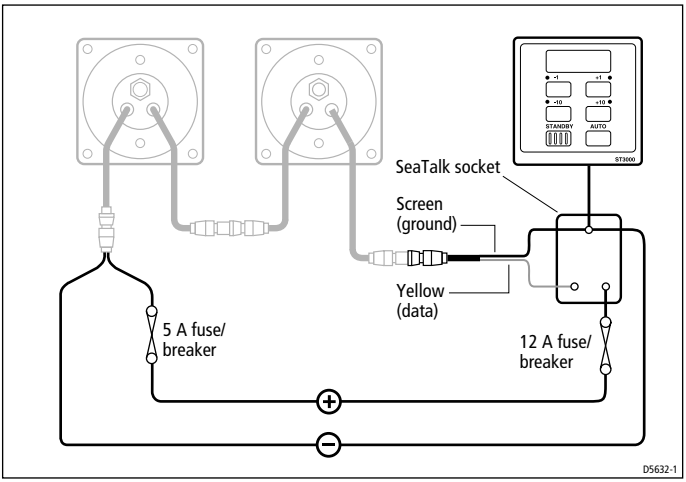


Part no.	Type	Length
D229	Flat moulded plug to bare ends	1 m (3 ft 3 in)
D179	Male round plug to bare ends	3 m (9 ft 10 in)
D181	Female round plug to bare ends	3 m (9 ft 10 in)

D5554-1



Connecting ST3000 control unit to ST60 instruments



Connecting ST3000 control unit to ST50 instruments

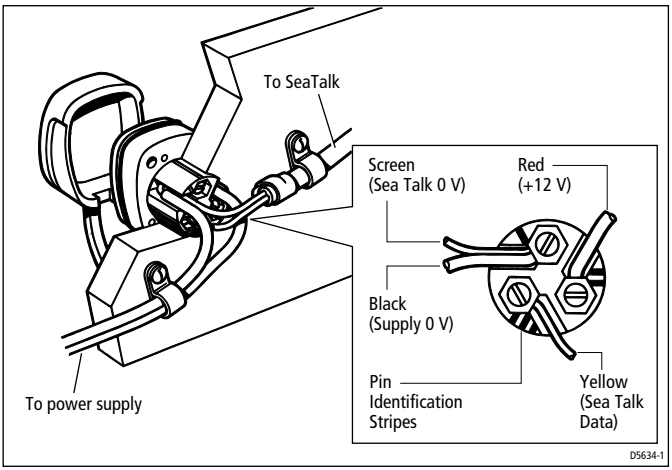
NMEA cabling

To connect NMEA equipment, you will need to use a SeaTalk/NMEA interface (part number: E85001) to convert the NMEA information into SeaTalk data. You can then connect the SeaTalk/NMEA interface to the SeaTalk socket.

Mounting the socket

To mount the SeaTalk socket:

1. Fix the template (supplied at the end of the handbook) onto the bulkhead at the selected socket location
2. Carefully drill the 18 mm ($^{23}/_{32}$ in) clearance hole and 2.4 mm ($^{3}/_{32}$ in) pilot holes, then remove the template.
3. Fit the plug cap to the socket body.
4. Locate the O-ring seal into the groove between the plug cap and socket body.
5. Cut and strip back the power cables and SeaTalk cables (if fitted).
6. Thread both cables through the bulkhead hole and connect to the relevant pins on the socket.
7. Attach the socket to the bulkhead using the two self tapping screws supplied.
8. Secure the cables to the bulkhead.



4.3 Drive unit installation

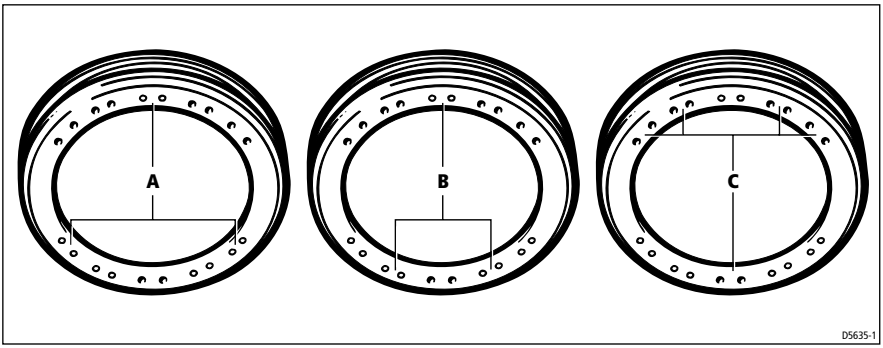
The Raymarine 3000 wheel drive is designed to operate with steering systems having between 1 and 3 turns lock to lock. Steering systems with more than 3 turns lock to lock may cause impaired steering performance due to reduced rate of rudder application.

Lost motion in the steering system must not exceed 2% of total movement. This is equivalent to 15° of free wheel movement for a system with 2 turns lock to lock. If lost motion exceeds this level it must be corrected, otherwise steering performance will be impaired.

Attaching the wheel drum

The drum is clamped to the wheel spokes using the three U-bolts provided. You can use the standard wheel drum on wheels with 3, 5 or 6 spokes:

- A holes: 3 and 6 spoke wheels
- B holes: 5 spoke wheels
- C holes: 3, 5 or 6 spoke wheels with spoke diameter of 26 mm (1 in) – these holes require special U-bolts (part number D103)



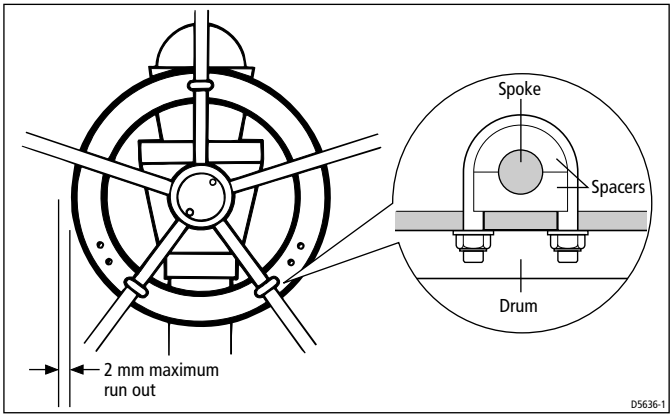
Note: *For 4 spoke wheels, contact Raymarine Technical Services to obtain a specially drilled drum.*

Position

Ideally, you should fit the wheel drum behind the wheel (i.e. between the wheel and the pedestal, as shown in the following diagram). To do this, you will need to remove the wheel.

If there is insufficient clearance behind the wheel, you can fit the wheel drum in front of the wheel.

The drum comes with three complete sets of spacers to fit differing spoke diameters.The spoke diameter is marked alongside each spacers – break off the appropriate spacers for your wheel spokes.



Use the U-clamps to secure the wheel drum to the wheel spokes:

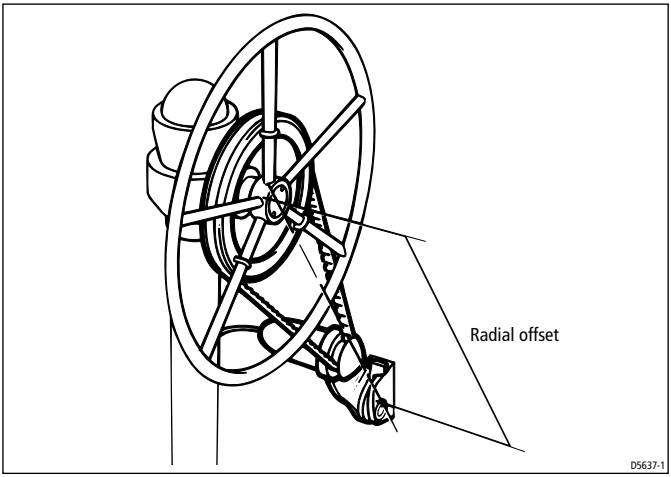
- roughly position the drum on the wheel and then lightly tighten the clamp nuts
- check if the drum is central by spinning the wheel
- re-position the drum until it is central – with a total run-out less than 2 mm ($^1/_{16}$ in)
- when the drum is central on the wheel, tighten the clamp nuts

Mounting the drive unit and belt

Standard installation

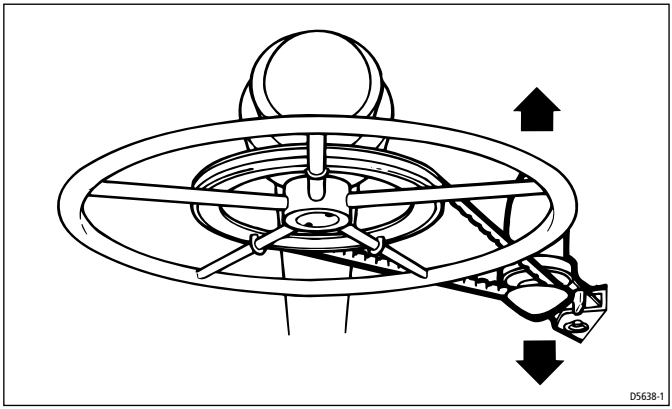
The drive unit is normally mounted on the cockpit side wall. If the standard belt does not allow a convenient location for the mounting clevis, you will need to purchase one of the alternative belt sizes to increase or decrease the radial offset of the mounting pin.

Belt name	Part number	Radial off-set
B-	D037	512 mm (20.1 in)
A-	D038	546 mm (21.5 in)
Standard belt	D039 (supplied)	598 mm (23.5 in)
A+	D040	717 mm (28.2 in)
B+	D041	850 mm (33.5 in)

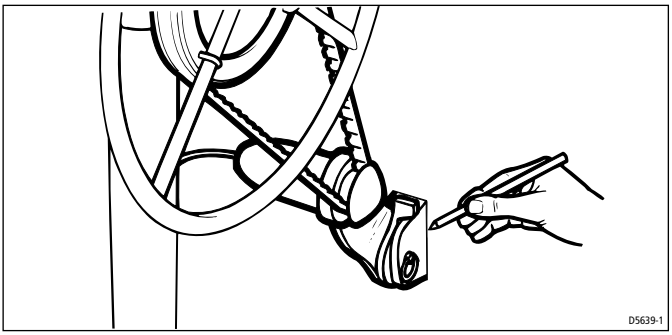


Attaching the mounting clevis

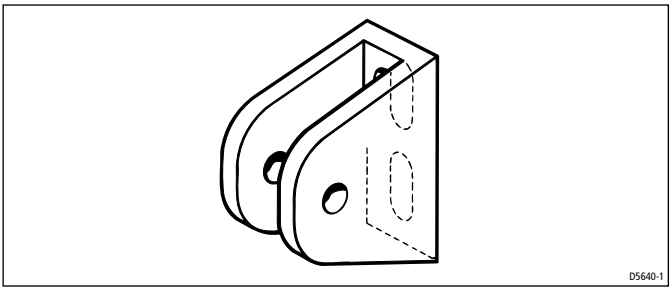
1. Fit the mounting clevis to the drive unit using the pin provided. Then loop the belt drive over the drum and the drive sprocket.
2. Rotate the clutch lever fully clockwise against its stop (i.e. to the 'tight belt' position) and then offer the clevis against the vertical side-wall.
3. Move the clevis down against the side wall until the belt is just taut. Then adjust the fore-and-aft position of the clevis until the belt lies **parallel** to the wheel. To help check if the belt is running parallel, use a long straight edge such as a sail batten.



4. When you have determined the correct position for the clevis, carefully draw around its base.

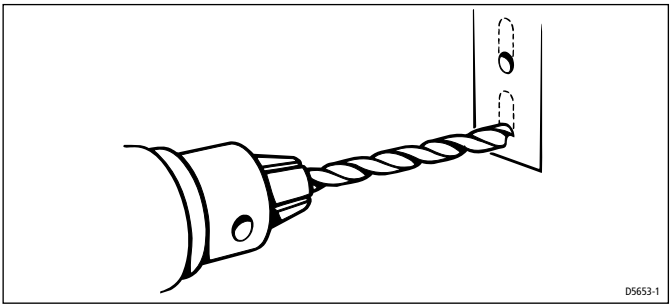


5. Remove the drive unit and draw around the inside of the elongated fixing holes on the clevis.

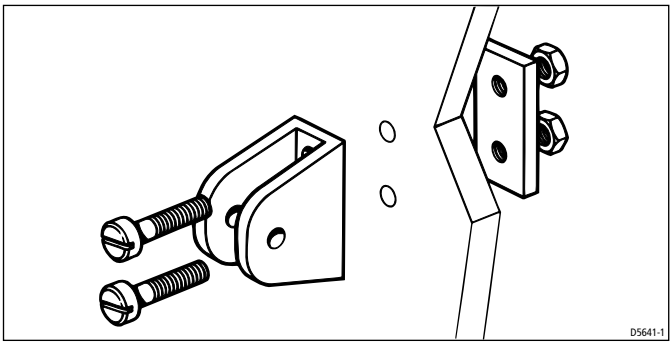


6. Drill two 8 mm ($^{5}/_{16}$ in) clearance holes for the clevis fixing bolts at the **lower end** of each elongated hole position. This allows the belt to be subsequently tightened if necessary.

Note: *Before drilling the holes, check that you have access to the other side of the mounting wall to attach the nuts!*



7. Bolt the mounting clevis into position with the fixing bolts positioned **mid-way** in the elongated holes. This will ensure that the belt is taut when you rotate the clutch lever fully clockwise to tension the belt.



8. Re-assemble the complete drive system and then check the clutch operation. If necessary, reposition the clutch lever on the splined eccentric bush to ensure that the lever can rotate 180° without obstruction.
9. Check the belt tension:
   - when the belt is tensioned by rotating the clutch lever fully clockwise, you should be able to back-wind the drive unit by slowly rotating the wheel. If belt slip occurs, increase belt tension by reclamping the clevis in a slightly lower position.
   - when the clutch lever is rotated fully anti-clockwise the wheel drum should slip easily against the belt
   - **do NOT over tighten the belt**

Drive unit cabling

Plug the drive unit cable into the socket on the underside of the ST3000 control unit.

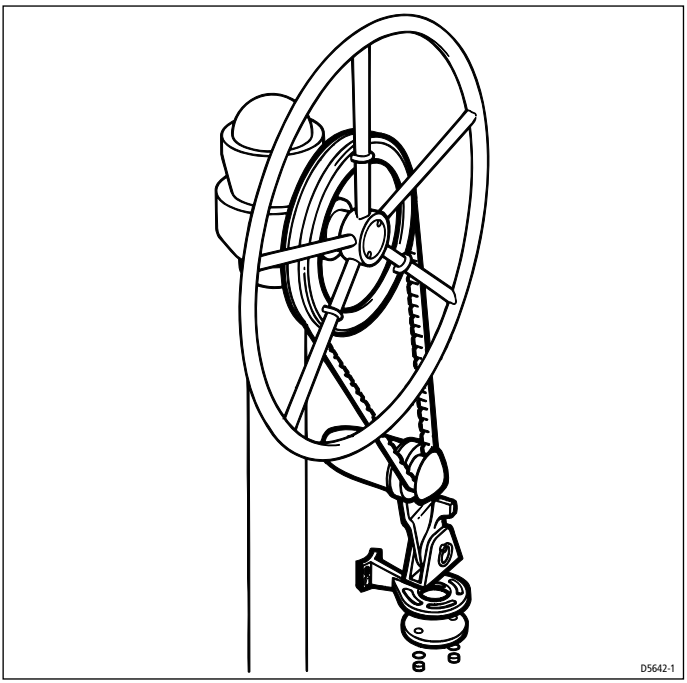
Alternative installations

Pedestal bracket

A special bracket is available to mount the drive unit directly onto the wheel pedestal (part number: D044).

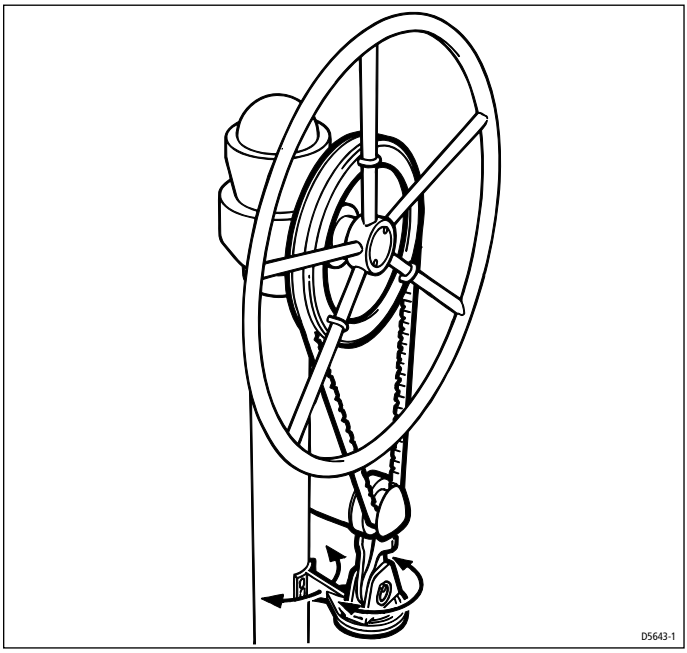
Attach the pedestal bracket as follows:

1. Loosely attach the mounting clevis to the pedestal bracket using the backing plate and the two bolts provided.
2. Attach the mounting clevis to the drive unit using the pin provided and loop the belt drive over the drum and the drive unit sprocket.

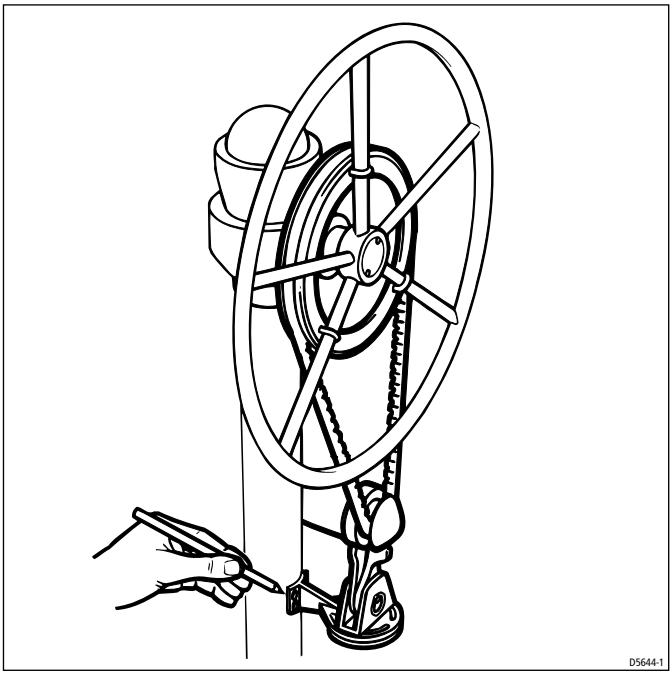


3. Rotate the clutch lever fully clockwise against its stop (to the 'tight belt' position), then offer the bracket against the pedestal.

4. Move the bracket down against the pedestal until the belt is just taut. The slide the pedestal bracket around the pedestal and rotating the clevis bracket to ensure that the belt runs **parallel** to the wheel.

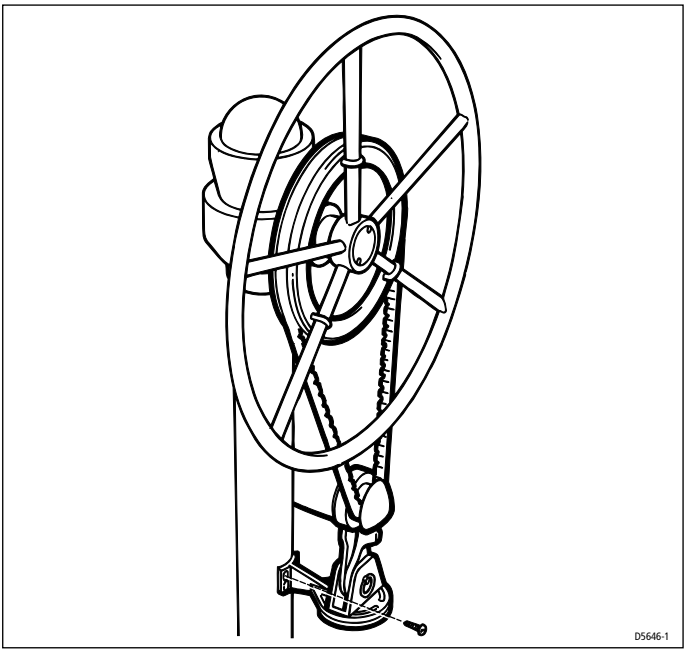


5. When you have determined the correct position for the pedestal bracket, carefully draw around its base and inside its the elongated fixing holes.



6. Tighten the clevis mounting bolts.
7. Drill four 4.3 mm ($^{11}/_{64}$in) pilot holes for the pedestal bracket fixing screws at the **lower end** of each elongated hole position. This allows the belt to be subsequently tightened if necessary.

8. Screw the pedestal bracket into position with the self tapping screws mid-way in the elongated holes. This will ensure that the belt is taut when you rotate the clutch lever fully clockwise to tension the belt.

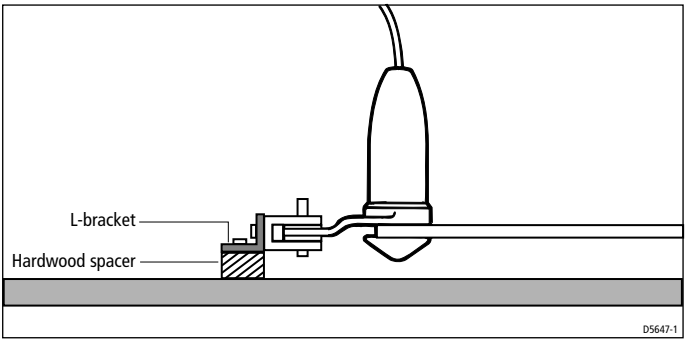


9. Re-assemble the complete drive system and then check the clutch operation. If necessary, reposition the clutch lever on the splined eccentric bush to ensure that the lever can rotate 180° without obstruction.
10. Check the belt tension:
    - when the belt is tensioned by rotating the clutch lever fully clockwise, you should be able to back-wind the drive unit by slowly rotating the wheel. If belt slip occurs, increase belt tension by reclamping the clevis in a slightly lower position.
    - when the clutch lever is rotated fully anti-clockwise the wheel drum should slip easily against the belt
    - **do NOT over tighten the belt**

Mounting on transverse bulkheads

If the steering wheel is mounted on a transverse bulkhead, you will need to make special provision to mount the drive unit. You can obtain as L-bracket (part number: D047) from your Raymarine dealer to mount the clevis on the bulkhead as shown.

Note: *You may also need to make a hardwood spacer to ensure correct belt alignment with the wheel drum.*



Alternative drive unit mounting positions

The wheel drive unit may be positioned on either the port or starboard side of the wheel. The fluxgate compass is calibrated to give correct steering sense when the drive unit sprocket is facing aft. Access to the clutch lever is also easier when the drive unit is mounted this way round.

However, if an obstruction prevents you from mounting the drive unit with the drive sprocket facing aft, you can mount it with the sprocket facing forward. In this case, you will need to re-adjust the motor drive sense to regain correct steering – see *page 53*.

Chapter 5: Commissioning the Wheel Pilot

This chapter explains how to commission your wheel pilot after installation. This consists of a number of simple functional tests followed by a short sea trial.

5.1 Functional tests

Switch on

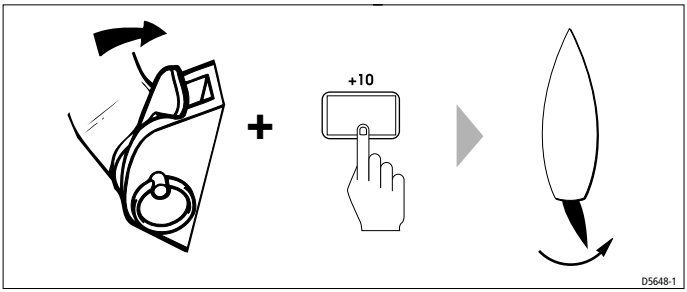
1. Switch on the main power breaker.
2. The control unit should beep and display the pilot type (ST3000).
3. Within 2 seconds, the display should show a flashing 'C' followed by the compass heading (for example, C 234). This shows the autopilot is active.

Note: *If the wheel pilot does not beep or display the compass heading, please refer to the Fault Finding section (see page 30).*

Operating sense

The operating sense defines the direction the wheel pilot will apply helm when a course change key is pressed or the boat goes off course. To check the operating sense:

1. Turn the clutch lever fully clockwise to engage the clutch.
2. Press **+10**.
3. The wheel should move to produce a turn to starboard.



4. If the wheel movement produces a turn to port, refer to the following instructions on reversing the operating sense.

Note: *You should only need to reverse the operating sense if you have installed the drive with the sprocket facing forward (see page 52).*

Reversing the operating sense

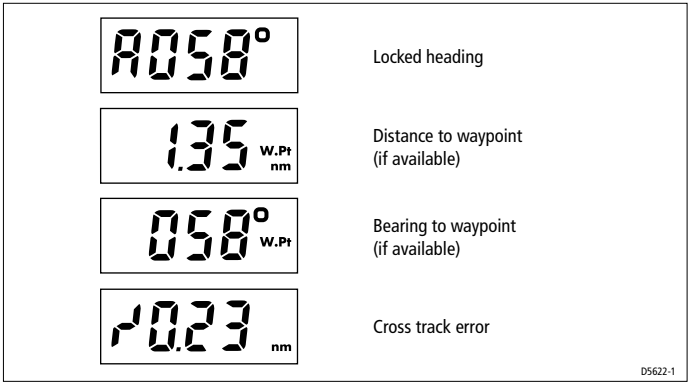
If necessary, reverse the operating sense as follows:

1. Press **-1** and **+1** together for 5 seconds.
2. The display shows the new operating sense (port or starboard) for 5 seconds, and then the autopilot reverts to normal operation.

Checking the navigation interface

If you have connected the wheel pilot to a navigator, check the interface as follows:

1. Set up a track on the navigator to give a Cross Track Error between 0 nm and 0.3 nm.
2. Enter Auto mode by pressing **AUTO**.
3. Enter Track mode by pressing **-10** and **+10** together.
4. After 3 seconds, the pilot should automatically scroll through the navigation displays:

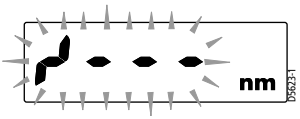


Navigation error screens

If the display shows one of the following errors, the cause is either:

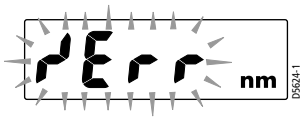
- a wiring error (either open circuit, short circuit or wires reversed) or
- the navigator is not configured to transmit the required data format (refer to the navigator handbook)

Track data not received



The wheel pilot displays this message if you select Track mode when the autopilot is not receiving SeaTalk navigation data.

Track data error



The wheel pilot displays this message if you select Track mode when the navigator has lost its fix. This display will clear as soon as the navigator regains its fix.

Checking the wind instrument interface

If you have connected the wheel pilot to a wind instrument, check the data link as follows:

1. Press **STANDBY** and **AUTO** together.
2. The wheel pilot should display a 'W' and the locked heading.

If the display continues to show a flashing 'C' and the current heading, the wheel pilot is not receiving any wind data. The most likely reason is a cabling error – either open circuit, short circuit or wires reversed.

Checking the SeaTalk interface

If you have connected the wheel pilot to other instruments or control units via SeaTalk, check the link as follows:

1. Press **STANDBY** on the ST3000 control unit.
2. Select display illumination level 0 (LAMP 0) on any other SeaTalk instrument or autopilot control unit.
3. The ST3000 control unit should immediately respond by switching off its display illumination. If the illumination does not switch off, there is a cabling fault between the ST3000 and the SeaTalk instruments.

5.2 Initial sea trial

CAUTION:

Failure to carry out the sea trial may result in impaired autopilot performance on some compass headings.

When you have checked that the system is operating correctly, you must complete a short sea trial to calibrate the compass.

The wheel pilot has a built-in calibration capability so you can fine-tune it to suit your boat, its steering system and its dynamic steering characteristics.

As supplied from the factory, the autopilot is calibrated to provide safe, stable control for most boats.

- Do not attempt to make any permanent changes to the recommended calibration values until you have completed the sea trial.
- You **must** carry out the initial sea trial in conditions of light wind and calm water – so you can assess the autopilot's performance without the influence of strong winds or large waves.

Note: At any time during the sea trial, you can disengage the clutch lever to return to hand-steering.

Before starting the sea trial

Before carrying out the sea trial, you should:

- check the calibration settings and, if necessary, reset them to the default values (see *page 63*)
- check the installation to make sure that it is not affected by radio transmissions, engine starting, etc.

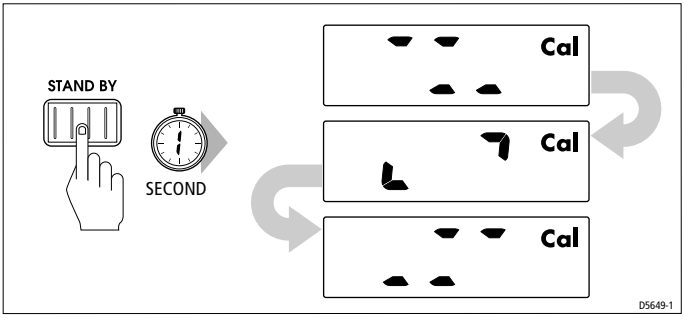
Calibrating the compass

Automatic compass deviation correction

By completing the following compass correction procedure, the wheel pilot can correct its own internal fluxgate compass for most deviating magnetic fields. **You MUST complete the Compass Deviation Correction at the beginning of your sea trial.**

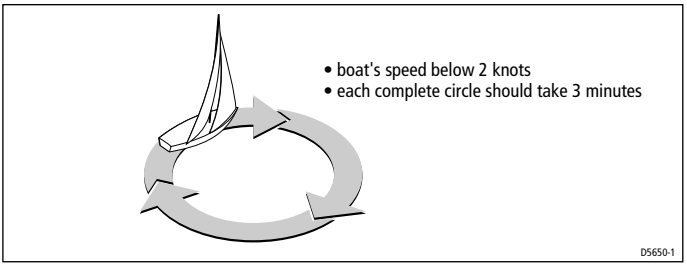
To complete the compass correction:

1. Press and hold **STANDBY** for 1 second – a series of dashes will cycle around the display.

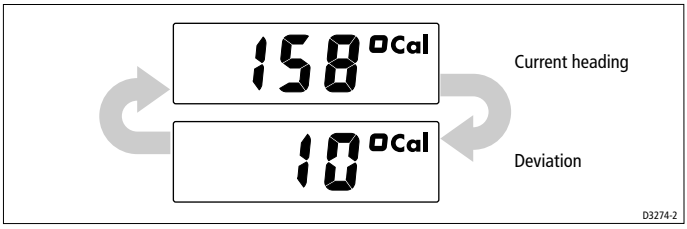


Note: *If you see a 'CAL OFF' message instead of the dashes, calibration access has been prevented. Refer to page 66 for details.*

2. Keeping boat speed below 2 knots, turn the boat in slow circles. You should take at least 3 minutes to complete each 360°.



3. Keep turning your boat until the display changes to show the amount of deviation the autopilot has detected. The deviation alternates with the autopilot's current heading every second.



Note: *If the deviation exceeds 15° you should re-site the control unit to a location less affected by magnetic interference.*

Heading alignment

1. Steer your boat on a straight course, then use **-1** and **+1** to adjust the displayed autopilot heading until it agrees with the boat's steering compass or a known transit bearing.
2. Exit compass linearization and heading alignment and store the compass correction/alignment values as follows:
   - press and hold **STANDBY** for 1 second until the pilot beeps
   - or, to exit without saving any new settings, press **STANDBY** momentarily

Note: *For installations where an ST50 or ST30 Steering Compass instrument is connected to the SeaTalk bus,* ***and*** *the Steering Compass has a fluxgate transducer connected, it is only necessary to carry out the auto deviation correction on the Steering Compass Instrument (refer to Steering Compass handbook instructions).*

Further adjustments to heading alignment

If the heading alignment requires further adjustment after the initial sea trial:

1. Enter Compass Deviation Correction by pressing **STANDBY** for 1 second.
2. Press **AUTO** to skip Deviation Correction and proceed to Heading Alignment.
3. Adjust the heading as described above.
4. Press and hold **STANDBY** for 1 second to save changes and exit.

Autopilot operation

Having calibrated the compass, the following procedure is recommended to familiarize yourself with autopilot operation:

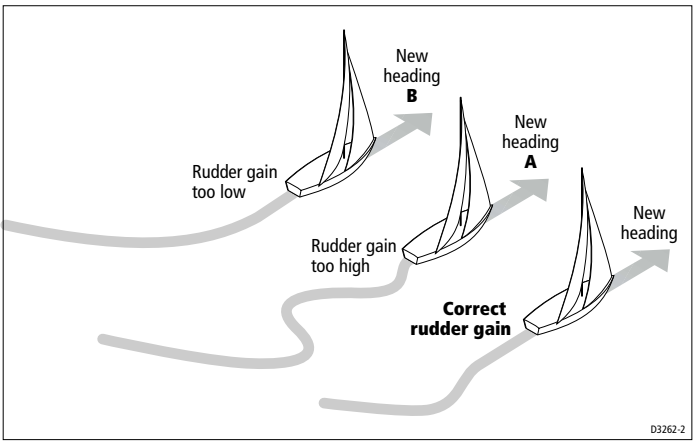
1. Steer onto a compass heading and hold the course steady.
2. Engage the wheel drive clutch by rotating the clutch lever clockwise.
3. Press **AUTO** to lock onto the current heading. The wheel pilot should achieve a constant heading in calm sea conditions.
4. Use the course change keys to alter course to port or starboard in multiples of 1° and 10°.
5. Press **STANDBY** and disengage the clutch lever to return to hand steering.

5.3 Adjusting autopilot performance

The factory setting for rudder gain provides stable control for initial sea trials. However, different boats can vary widely in their response to the helm and further adjustment to the rudder gain may improve the autopilot's steering characteristics.

The following test will determine whether the rudder gain is set too high or too low.

1. In clear water and with the autopilot in Auto mode, alter course to starboard by 40° by pressing **+10** four times.
   - At cruising speeds, a course change of 40° should result in a crisp turn followed by an overshoot of no more than 5°.
     If this occurs the rudder gain is set correctly.
   - If rudder gain is too high, the 40° course change will result in a distinct overshoot of more than 5° (A).
     Correct this oversteer by reducing the rudder gain setting.
   - If rudder gain is too low, the boat's steering performance will be sluggish – it will take a long time to make the 40° turn and there will be no overshoot (B).
     Correct this understeer by increasing the rudder gain setting.



Note: *It is easier to recognize these actions in calm sea conditions where wave action does not mask basic steering performance.*

2. Refer to the calibration menu diagram in *Chapter 6: Adjusting Wheel Pilot Settings*, for instructions on how to adjust the rudder gain setting.
3. Repeat the test until you achieve crisp course changes with no more than 5° of overshoot.

You should set the rudder gain to the lowest setting consistent with accurate course keeping. This will minimize drive movements and reduce power consumption and wear and tear.

Chapter 6: Adjusting Wheel Pilot Settings

6.1 Introduction

The wheel pilot is calibrated at the factory to provide stable performance for most boats. However, you can fine tune many of the calibration features to match your personal preferences, and the type of boat and steering system.

Note: *You should carry out an initial sea trial **before** adjusting any of the calibration features.*

You might need to adjust the wheel pilot calibration settings if:

- the pilot does not maintain a selected heading
- the rudder activity is too high or the course keeping is not tight enough.
- the boat appears to be unstable on Northerly headings (or Southerly headings in the southern hemisphere)
- you operate in Track Control mode without a speed instrument
- you wish to change the Off Course alarm angle

The calibration menu allows you to adjust the following parameters from their factory default settings:

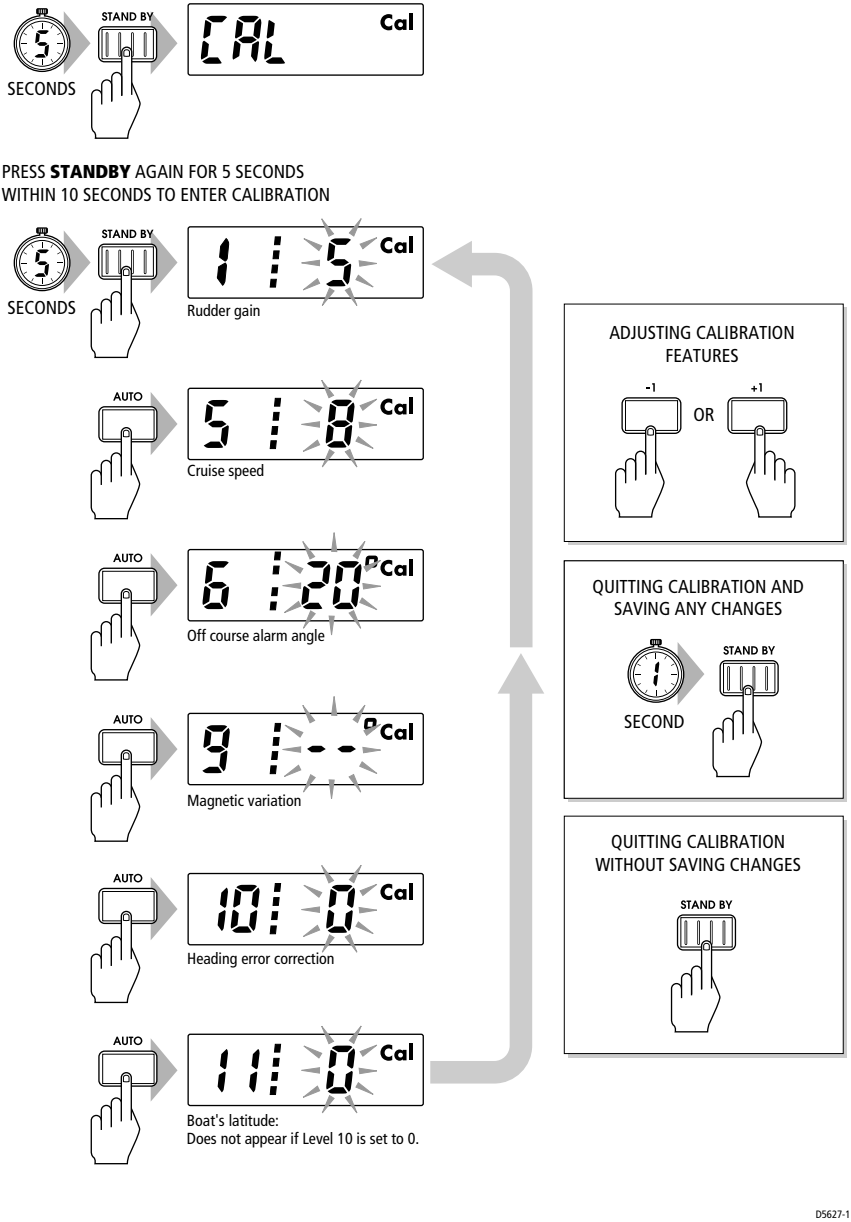
- rudder gain
- average cruise speed
- off course alarm limit
- variation
- Northerly/Southerly turning error compensation
- boat's current latitude

Adjusting calibration values

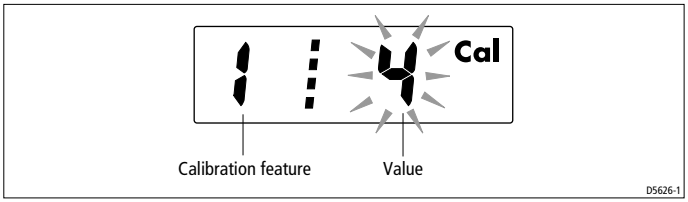
The flowchart on the next page shows how to:

- enter the calibration menu
- scroll through the calibration menu
- adjust the calibration values
- quit calibration

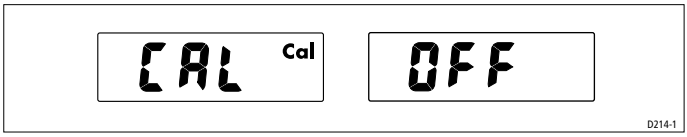
Calibration menu



Calibration features



- The number on the left identifies the calibration feature and the number on the right the currently selected value.
- You can enter the calibration menu to view the existing values without altering them. After viewing the value, a momentary press of **STANDBY** returns the pilot to its normal operating mode without affecting the previous settings.
- If the display shows CAL OFF when you try to enter calibration, refer to *page 66*.



Default calibration values

The following table shows the default calibration values. These will provide safe performance for initial sea trial.

No.	Feature	Default setting	Adjusted values
1	Rudder gain	5	
5	Average cruise speed	8	
6	Off course alarm angle	20	
9	Local magnetic variation	Off (– –)	
10	North/South turning error correction	Off (0)	
11	Boat's current latitude	0	

Note: *Calibration Levels 2,3,4,7 and 8 are not available. If Calibration Level 10 is set to 0, level 11 will also be omitted.*

6.2 Calibrating the wheel pilot

Calibration Level 1: Rudder gain

Use Calibration Level 1 to adjust the rudder gain. This must be set when your boat is under way, as described on *page 59*.

Calibration Level 5: Cruise speed

Use Calibration Level 5 to set the boat's normal cruising speed for operation in Track mode.

When interfacing with a navigation system, the wheel pilot uses the boat's average cruising speed to perform track calculations.

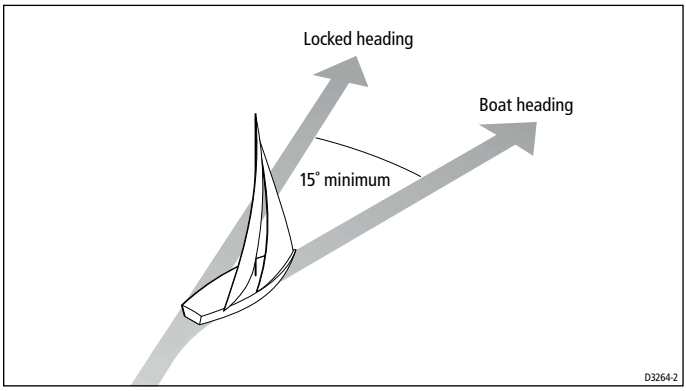
Note: *If a SeaTalk speed instrument is connected, boat speed data will be transmitted directly to the autopilot.*

Calibration Level 6: Off course alarm angle

Use Calibration Level 6 to set the off course alarm angle. This alarm warns you if the autopilot is unable to maintain its set course.

The off course alarm operates if the autopilot strays off course, by more than the set value, for more than 20 seconds.

You can set the limit in 1° increments between 15° and 40°.



Calibration Level 9: Magnetic variation

Use Calibration Level 9 to input the level of magnetic variation present at the boat's current position.

- -ve variation = west
- +ve variation = east

The wheel pilot transmits this value onto the SeaTalk bus, so it can be picked up by other SeaTalk instruments.

Calibration Level 10: Heading error correction

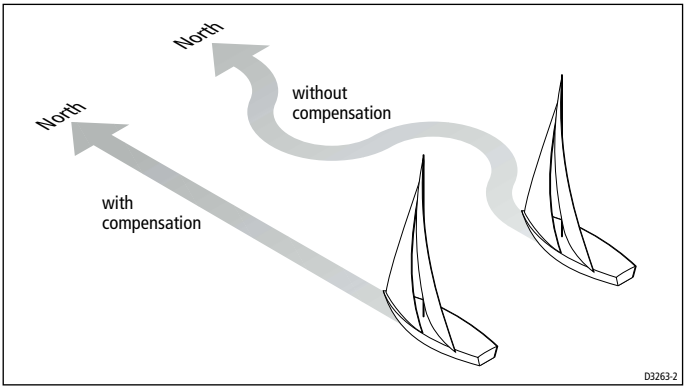
Use Calibration Level 10 to switch on Northerly or Southerly heading error correction:

- 0 = Off
- 1 = Northern Hemisphere, 2 = Southern Hemisphere

You might notice that the autopilot tends to be a little less stable on Northerly headings in the higher latitudes of the Northern hemisphere (or Southerly headings in the Southern hemisphere).

This is caused by the increasing angle of dip of the earth's magnetic field at higher latitudes, which has the effect of amplifying rudder response on Northerly (Southerly) headings. This error affects all magnetic compasses and gets worse further away from the equator.

With heading error correction switched on, the wheel pilot can compensate for this error by automatically adjusting the autopilot gain (depending on heading). This will provide precise course keeping on all headings.



Calibration Level 11: Boat's current latitude

When you have switched on heading error correction (Level 10), you need to use Calibration Level 11 to input the boat's current latitude (to the nearest degree).

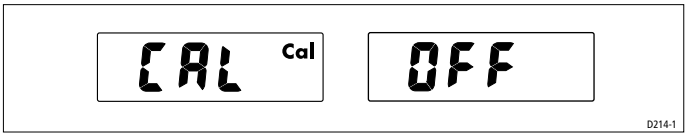
Set the latitude using the **-1**, **+1**, **-10** and **+10** keys.

Note: *If the correction is switched off in Calibration Level 10 (i.e. set to '0'),Level 11 will be omitted. When you press the* **AUTO** *key in Calibration Level 10 you will advance to Level 13.*

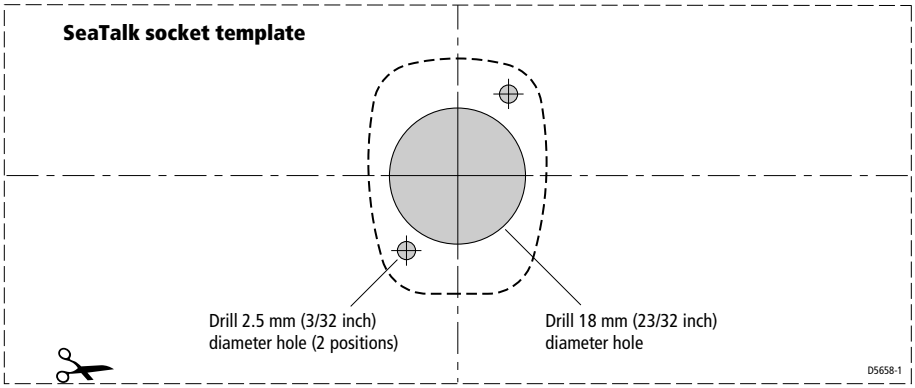
Controlling access to calibration

You can prevent unauthorized access to calibration as follows:

1. Press and hold **-1** and **STANDBY** together for 10 seconds until the display shows CAL OFF:



2. Toggle the calibration access between OFF and On using the **-1** and **+1** keys.
3. Store the setting by pressing **-1** and **standby** for 10 seconds until the wheel drive returns to normal operation.


SeaTalk socket template
Drill 2.5 mm (3/32 inch)
diameter hole (2 positions)
Drill 18 mm (23/32 inch)
diameter hole
D5658-1

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Limited Warranty Certificate

Raymarine warrants each new Light Marine/Dealer Distributor Product to be of good materials and workmanship, and will repair or exchange any parts proven to be defective in material and workmanship under normal use for a period of 2 years/24 months from date of sale to end user, except as provided below.

Defects will be corrected by Raymarine or an authorized Raymarine dealer. Raymarine will, except as provided below, accept labor cost for a period of 2 years/24 months from the date of sale to end user. During this period, except for certain products, travel costs (auto mileage and tolls) up to 100 round trip highway miles (160 kilometres) and travel time of 2 hours, will be assumed by Raymarine only on products where proof of installation or commission by authorized service agents, can be shown.

Warranty Limitations

Raymarine Warranty policy does not apply to equipment which has been subjected to accident, abuse or misuse, shipping damage, alterations, corrosion, incorrect and/or non-authorized service, or equipment on which the serial number has been altered, mutilated or removed.

Except where Raymarine or its authorized dealer has performed the installation, it assumes no responsibility for damage incurred during installation.

This Warranty does not cover routine system checkouts or alignment/calibration, unless required by replacement of part(s) in the area being aligned.

A suitable proof of purchase, showing date, place, and serial number must be made available to Raymarine or authorized service agent at the time of request for Warranty service.

Consumable items, (such as: Chart paper, lamps, fuses, batteries, styli, stylus/drive belts, radar mixer crystals/diodes, snap-in impeller carriers, impellers, impeller bearings, and impeller shaft) are specifically excluded from this Warranty.

Magnetrons, Cathode Ray Tubes (CRT), TFT Liquid Crystal Displays (LCD) and cold cathode fluorescent lamps (CCFL), hailer horns and transducers are warranted for 1 year/12 months from date of sale. These items must be returned to a Raymarine facility.

All costs associated with transducer replacement, other than the cost of the transducer itself, are specifically excluded from this Warranty.

Overtime premium labor portion of services outside of normal working hours is not covered by this Warranty.

Travel cost allowance on certain products with a suggested retail price below $2500.00 is not authorized. When/or if repairs are necessary, these products must be forwarded to a Raymarine facility or an authorized dealer at owner's expense will be returned via surface carrier at no cost to the owner.

Travel costs other than auto mileage, tolls and two (2) hours travel time, are specifically excluded on all products. Travel costs which are excluded from the coverage of this Warranty include but are not limited to: taxi, launch fees, aircraft rental, subsistence, customs, shipping and communication charges etc. Travel costs, mileage and time, in excess to that allowed must have prior approval in writing.

TO THE EXTENT CONSISTENT WITH STATE AND FEDERAL LAW:

(1) THIS WARRANTY IS STRICTLY LIMITED TO THE TERMS INDICATED HEREIN, AND NO OTHER WARRANTIES OR REMEDIES SHALL BE BINDING ON RAYMARINE INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABLE OR FITNESS FOR A PARTICULAR PURPOSE.

(2) Raymarine shall not be liable for any incidental, consequential or special (including punitive or multiple) damages.

All Raymarine products sold or provided hereunder are merely aids to navigation. It is the responsibility of the user to exercise discretion and proper navigational skill independent of any Raymarine equipment.

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Stick barcode label here

Purchased from

Purchase date

Dealer address

Installed by

Installation date

Commissioned by

Commissioning date

Owner's name

Mailing address

This portion should be completed and retained by the owner.